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3   PORTABLE WIRELESS DEVICE AND PRINT DEVICE
4   PRINT BY REFERENCE PROTOCOL

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6   FIELD OF THE INVENTION

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8   A field of the invention is wireless device communication protocols.

9   An additional field of the invention is printing.

10   BACKGROUND OF THE INVENTION

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12   Portable wireless devices such as personal digital assistant (PDA)

13   devices and portable wireless handsets, e.g., cell phones, enjoy widespread

14   popularity. The popularity of these devices invites attempt to expand their uses.

15   The introduction of Internet browsing in PDA devices and wireless handset

16   devices is an excellent example of the effort to expand the device uses. As device

17   uses increase, commercial service opportunities increase. The introduction of

18   Internet capabilities into the portable wireless devices permits the sale of wireless

19   access.

20   The limited memory, display, and bandwidth capabilities of portable

21   wireless devices limits commercial opportunities by restricting the type of content

22   readily available to a wireless device user. Content is typically formatted

23   specifically for a wireless device in a way to conserve device capabilities. Rich

24   content is avoided in favor of bare bones content. Users will accordingly favor

25   more traditional connections through personal computers and work stations unless

1 circumstances such as travel prevent access to such computers. In many ways, the

2 PDA devices and wireless handsets remain a content access method to be used for

3 highly basic content or to access content only when circumstances prevent a user

4 from accessing content from another device.

5 Printing offers the opportunity for a user to view rich content, and is

6 often favored over viewing content through a full web browser or other application

7 on a personal computer or work station. In contrast, the wireless devices with

8 limited capabilities lack convenient printing mechanisms. Operations to connect

9 the devices via a wired connection almost defeat the purpose of having a portable

10 wireless device in the first place.

11 One answer to these concerns is found in efforts to have the portable

12 wireless devices communicate with peripherals and other devices through wireless

13 communications. The Bluetooth RF communication format, for example, is

14 directed toward expanding the utility of portable wireless devices by providing a

15 short range, typically about 10 meters, communication channel for

16 communications between portable wireless devices and other Bluetooth capable

17 devices. Standing alone, the communication channel offers little to solve the print

18 content dilemma faced by users of portable wireless devices, though. Due to the

19 memory and bandwidth limitations portable wireless devices are relatively poor

20 portals to push content from or through to a printer, even with the convenience of

21 a Bluetooth or other similar wireless communication capability.

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23 SUMMARY OF THE INVENTION

24 Wireless print by reference allows a portable device to conveniently

25 access print content by a wireless communication with a print device

26 communicating a referenced print content to the print device, which then accesses

27 and prints the print content. In a typical preferred example, the portable wireless

28 device might obtain a reference to a print content, e.g., a Universal Resource

29 Locator, while performing an operation such as web browsing over a wireless

1   network. The present invention provides a protocol that allows a portable wireless

2   device, such as a handheld personal digital assistant, to initiate a print job with a

3   printer by indicating the nature of the communication as a print by reference

4   operation and identifying a location including print content. The protocol is

5   preferably used as the body of a Generic Object Exchange (OBEX) packet in a

6   Bluetooth RF communication initiated by the portable wireless device with a

7   Bluetooth capable print device, e.g., a printer or multi-function peripheral with a

8   print capability. A preferred embodiment of the wireless communication protocol

9   uses the body of an OBEX packet communicated by Bluetooth RF to include a tag

10   identifying a packet body as being a packet body for a print by reference operation

11   and a location identifying the location of the print content. With a preferred

12   extensible mark-up language format, the location comprises an attribute.

13   Additional attributes may, for example, include attributes enabling security

14   clearance, billing identifications, use of supporting print services, and

15   identification of alternate locations for targeted print content.

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17   BRIEF DESCRIPTION OF THE DRAWINGS

18   FIG. 1 is a communication flow diagram indicating a simple print by

19   reference communication exchange in accordance with a preferred embodiment of

20   the present invention;

21   FIG. 2a illustrates a preferred OBEX simple reference packet

22   structure for a preferred embodiment of the present protocol;

23   FIG. 2b illustrates a preferred OBEX XML reference packet

24   structure for a preferred embodiment of the present protocol; and

25   FIG. 3 illustrates a preferred environment and usage model for a

26   protocol of the invention.

1   DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

2   A simple form of the invention is a protocol permitting, as a

3   minimum, identification of a communication by a portable wireless device as

4   relating to a print by reference operation and an indication of the location of the

5   print content to be printed. An identification tag and a Universal Resource

6   Locator meet these minimum requirements. A preferred embodiment relies upon a

7   Bluetooth wireless communication and embeds the minimum protocol

8   requirements in the body of a Generic Object Exchange (OBEX) packet body.

9   Some portable wireless devices will find this level of protocol sufficient, while

10   print devices and other portable wireless devices are more likely to benefit from an

11   embodiment of the present protocol that allows for the communication of

12   additional information concerning the print job, or features and services relating to

13   the print job. The preferred embodiment protocol discussed and illustrated herein

14   accounts for potential enhanced print by reference jobs, and features and services

15   relating to print jobs to afford enhanced usability and commercial prospects by use

16   of the present protocol. Artisans will appreciate, though, that the protocol in its

17   simple form offers the ability for a print by reference to be initiated successfully

18   by a portable wireless device with a simple identification of the print by reference

19   nature of the communication and an identification of the location of the print

20   content to be printed.

21   Bluetooth is a preferred wireless RF standard developed by a

22   technology industry consortium made up of 3Com, Ericsson, IBM, Intel, Agere,

23   Microsoft, Motorola, Nokia, and Toshiba with a mission of creating a standard

24   wireless protocol. More information, including protocol specifications, can be

25   obtained on the Bluetooth website: www.bluetooth.com, with the content available

26   from this and linked websites incorporated herein by reference. The current

27   Bluetooth protocol has an operable range of about 10 meters, but may sometimes

28   prove to have greater range. As an example software/device for the underlying

29   Bluetooth communication protocol, a Bluetooth PC card was unveiled by 3Com

1 on May 29, 2001. The card follows the new Bluetooth 1.1 specification and uses

2 3Com's connection manager software.

3   Other example communication protocols suitable for practice within

4 the scope of the invention that have available commercial support are those

5 specified by IEEE 802.11 standard. 100 meters is the optimal 802.11 maximum

6 range, but 802.11 can work at around 300 meters. However the data rate goes from

7 11 Mega bits per second to about 1 or 2 Mega bits per second as range increases.

8 Bluetooth power class III is designed for 10 meters at low power. Bluetooth Power

9 class I uses 100 milliwatts and can go about 100 meters. Artisans will also

10 appreciate that wireless protocols other than 802.11 and Bluetooth, e.g., infrared,

11 might also be used and that certain preferred features, e.g., an OBEX connect are

12 therefore unique to the preferred Bluetooth embodiment since the Bluetooth

13 protocol requires a CONNECT while OBEX does not.

14   FIG. 1 shows a communication exchange adopting a preferred

15 embodiment of the present protocol. In FIG. 1, a portable wireless device 10

16 initiates a wireless communication with a print device 12, which may be a printer

17 or multi-function peripheral including a print function. The wireless

18 communication occurs over a wireless communication channel. This is a

19 Bluetooth wireless communication in the preferred embodiment of FIG. 1, and

20 uses the OBEX packet exchange. The portable wireless device 10 establishes a

21 connection with the printer via the OBEX conventions. Once the OBEX

22 connection is established, via an OBEX connect and response exchange, the

23 portable device 10 uses the body of an OBEX packet to conduct a simple reference

24 push to the print device 12. The minimum information in the packet body must

25 identify the communication as concerning a print by reference operation, and must

26 indicate the location of the print content to be printed. The print device 12 may

27 respond with an acknowledgment.

28   FIG. 2a shows an exemplary OBEX packet 14 including the

29 minimum protocol information of a preferred embodiment protocol. The preferred

1   embodiment protocol uses a tag 16 identifying the packet information as print by

2   reference information and a Universal Resource Locator (URL) 18 identifying the

3   location of content to be printed. A standard OBEX packet header 20 precedes the

4   body 22 including the tag 16 and the URL 18. The nature of content to be printed

5   as a result of this communication is essentially unlimited by the remaining

6   capabilities of the portable wireless device 10.

7   A further preferred embodiment of the invention provides for

8   enhanced control over the print by reference operation and the opportunity to tie in

9   useful commercial features such as those relating to billing the user of a portable

10   wireless device 10 as part of a print by reference operation or ensuring secure

11   access to print content available for print by reference operations.   Use of an

12   extensible markup language (XML) format for the print by reference packet body,

13   as shown in FIG. 2b using the reference numbers assigned in FIG. 2a, permits the

14   inclusion of Meta information to be passed from the portable wireless device along

15   with the Universal Resource Locator. The preferred XML print by reference

16   packet body is an XML tag having the following syntax:

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17        <reference url="scheme://host/resourcepath"
18              attr1="attr1val" attr2="attr2val"...
19              attrn="attrnval" \>
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20   The "reference" is an XML tag and, in the above example, indicates a simple print

21   by reference communication for printing content from a location identified by the

22   "url" attribute following the "reference" tag. An identification of the location of

23   the print content meets the minimum requirement, and additional attributes "attr1"

24   – "attrn" may follow for enhanced print by reference operations. All of the

25   attributes are optional except for the URL that must be included and be fully

26   qualified. Table 1defines a set of attributes used in a preferred embodiment

27   protocol of the invention:

Attribute Name	Comment
label	Descriptive name of the resource referred to by the reference. (e.g. label="Sales Document")
url	Fully qualified Uniform Resource Locator (RFC 1738)
use_proxy	Fully qualified URL that represents an HTTP proxy service that must be used to access the content referred to by the reference. The Port for the proxy shall be specified in the URL if not port 80 (e.g. use_proxy="http://corp_proxy:8088")
use_service	Fully qualified URL that represents the location of a remote print service that shall be used to process the reference. (e.g. use_service="http://myprintsvc:456")
ip_addr	Internet Address of the sender (portable wireless device). Provides hint to the receiver (print device) that sender (portable wireless device) is an internet device. Examples: ip_addr="126.34.07.6" ip_addr="::126.34.07.6" ip_addr="FC01:0:0:0:0:0:0:23"
type	Encoding of the resource referred to by the reference. (e.g type="text/html")
cookie	Cookie that can be used by the receiver (print device) when processing the reference. This attribute uses the general form of the HTTP Cookie Mime header NAME1=OPAQUEVALUE; NAME2=OPAQUEVALUE (e.g. cookie=" CUSTOMER=WILE_E_COYOTE; PART_NUMBER=ROCKET_LAUNCHER_0001")
on401	Provides the receiver (print device) with information that can be used when an HTTP 401 security challenge is encountered while processing the reference. The format of this attribute is that of the HTTP

Attribute Name	Comment
	Authorization header defined in RFC2617. For example a credential that uses the "Basic" security scheme with the user id Aladdin and password "open sesame" would be encoded as follows: on401="Basic QWxhZGRpbjpvcGVuIHNlc2FtZQ=="
on407	Same as on401 except used in response to a HTTP 407 proxy challenge. The format is the same as on401
time	Used to signify the time the reference was sent to the Printer. Time is a byte sequence that gives the object's UTC date/time of last modification in ISO 8601 format. Local times should be represented in the format YYYYMMDDTHHMMSS and UTC time in the format YYYYMMDDTHHMMSSZ. The letter "T" delimits the date from the time. UTC time is identified by concatenating a "Z" to the end of the sequence. When possible UTC times should be used.
key	The key attribute is an optional attribute that can be used to associate security information with the reference. This can be used when challenged for security information. In general such keys should be encrypted and time sensitive to prevent arbitrary delegation from compromising security. The format of this attribute conforms to the Authorization field in RFC2617 and contains both the security scheme and the encrypted key. This format is the same as on401
on[status code]	This status code allows the sender (portable wireless device) to provide the receiver (print device) with an alternative URL to process in the event of a particular HTTP status code e.g. on400="http://www.bluetooth.org" The URL specified would be used in the event of a HTTP 400 status code

Attribute Name	Comment
billing	This code allows for billing services. As an example, a personal wireless device can provide a billing reference number to access print content requiring payment of a fee. The billing code might also be used for other fee based transactions, e.g. payment for use of a public access printer with print by reference capabilities or payment for use of a print service identified by the "use_service" attribute.
new_sheet	This Boolean attribute indicates to a print device or print service that a referenced print content should be printed beginning on a new sheet of media.

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2   The "url" attribute is a location attribute identifying the location of

3   the print content. The portable wireless device 10 provides the "url" attribute, e.g.,

4   "http://www.bluetooth.org" to identify the location of targeted print content to the

5   print device 12. A fully qualified URL is preferred, though the print device 12

6   may be set up to resolve less complete URL designations in a manner similar to

7   web browsers. In a contemplated use of the invention, the portable wireless

8   device 10 obtains the URL for a print by reference by clicking on a "print" link

9   while web browsing or reviewing other content including links.

10   The "label" attribute is a description attribute providing a name for

11   the location identified by the "url" attribute. This may be a descriptive name of

12   the resource to provide the content to be printed, for example. The descriptive

13   name could be useful to provide track print operations, by any device associated or

14   involved with the print by reference operation initiated by the portable wireless

15   device.

16   In the preferred embodiment detailed in Table 1, the "use_proxy"

17   attribute is a fully qualified URL that represents an HTTP proxy service that must

18   be used to access the content referred to by the reference. The Port for the proxy is

19   specified in the URL if it is not a default port, e.g., port 80. Ports are used in the

1   TCP to name the ends of logical connections which carry long term conversations.

2   For the purpose of providing services to unknown callers, a service contact port is

3   defined. The contact port is sometimes called the "well-known port". Port number

4   80 is the well known port number for HTTP and the world wide web. See, e.g.,

5   http://www.iana.org/assignments/port-numbers.

6   Content accessed by a print by reference operation may not be in

7   printer device format. "use_service" is an attribute identifying a location of a print

8   service to be used in accessing the print content. The print service retrieves the

9   content and formats the data in a format that the printer is able to print.

10   A print device 12 equipped with print by reference capabilities may

11   have a reason to recognize portable wireless devices. The "ip_address" facilitates

12   such recognition by identifying a wireless device Internet address. The

13   "ip_address" thus provides an indication to the print device 12 receiving a wireless

14   communication from the portable wireless device 12 with the print by reference

15   protocol that the portable wireless device is an Internet device.

16   Access to a referenced print content location may be limited by any

17   number of means to restrict access down from a level of universal public access.

18   The preferred embodiment protocol of Table 1 provides a number of attributes to

19   facilitate different access levels useful to assist in processing the print content as

20   part of a print by reference operation. The "type" attribute is an encoding type

21   attribute indicating how the print content at the location identified by the location

22   attribute is encoded. For example, type=html or type=pdf respectively indicate

23   html and pdf encoded content. The "cookie" attribute can associate a print by

24   reference job with previous information concerning reference content or portable

25   wireless device seeking to access referenced content. Thus, the cookie attribute

26   identifying a cookie usable to process the print content at the location identified by

27   the location attribute. Preferably, the cookie attribute uses a cookie name

28   formatted according to HTTP Cookie MIME header name conventions.

1   Security is another type of access control. "on401" and "on407" are

2 separate security attributes identifying security information that can be used in

3 response to a security challenge. Attribute "on401" is security information that

4 can be used in response to an HTTP 401 security challenge. Attribute "on407" is

5 security information that can be used in response to an HTTP 407 proxy challenge.

6 Preferably, the format of each of the HTTP 401 and HTTP 407 security attributes

7 is in accordance with the HTTP Authorization header of RFC2617. RFC indicates

8 an Internet standards-related specification published as part of the "Requests for

9 Comments" (RFC) document series. The archival series is the official publication

10 channel for Internet standards documents and other publications of the Internet

11 community. RFCs can be obtained from a number of Internet hosts using

12 anonymous gopher, World Wide Web, and other Internet document-retrieval

13 systems. RFCs are published by the Internet Engineering Task Force (IETF),

14 which is a large open international community of network designers, operators,

15 vendors, and researchers concerned with the evolution of the Internet architecture

16 and smooth operation of the Internet. RFCs are published by the IETF, see, e.g.,

17 http://www.ietf.org/rfc/html.

18   Time is useful in various security encoding or other operations. For

19 example, time stamps are often used to authenticate communications. The "time"

20 attribute indicates the time at which a packet is sent by the wireless device to

21 initiate a print of print content. The preferred "time" attribute gives the wireless

22 device's Universal Time Code date and time of last modification in ISO 8601

23 format. The "key" attribute associates security information with the reference tag,

24 and is preferably an encrypted and time-sensitive key.

25   A print by reference operation may be impeded by a print content

26 location that is experiencing difficulties or refuses to complete a print by reference

27 operation. In that case, the print by reference might proceed through an alternative

28 location including the same or substitute content. The "status code" attribute

29 indicates an alternative location to obtain such alternative print content.

1   Revenue generation may arise at different points of a print by

2   reference operation. Examples include schemes where portable wireless device

3   users pay for access to content or pay for access to print by reference printers.

4   Many other commercial models are possible, with the print by reference being tied

5   to a direct payment or stemming from a related commercial or promotional

6   transaction. Various debit and credit models of payment are facilitated by the

7   "billing" attribute that identifies one of the wireless device 10 or user of the

8   wireless device for billing purposes.

9   The "new_sheet" attribute is preferably a Boolean attribute that

10   indicates to a print device or print service that a referenced print content should be

11   printed beginning on a new sheet of media. As an example, new_sheet="false"

12   indicates that a referenced print content, e.g. a document, should not start on a new

13   sheet. This again, like all attributes excepting a reference to target print content, is

14   a preferred option. A print device or print service handling a print by reference

15   request from a portable wireless device 10 may have default settings for any one

16   of the preferred set of optional attributes or other optional attributes that may be

17   supported by a particular print device or print service. In the case of the

18   "new_sheet" attribute, a preferred default setting is new_sheet="true".

19   The discussed examples generally assume a simple and single print

20   by reference operation to print single content from a specific location. The

21   attributes add features and Meta information to enhance or assist printing from a

22   specific location. While a single reference print may be indicated by the

23   "reference" tag, additional types of print by reference operations can be supported

24   by having separate tags, e.g. "reference1", "reference2", etc. A preferred example

25   is a tag to indicate that attributes will follow for multiple print content references,

26   i.e., a reference list. Another preferred option is to use the packet header to

27   indicate the type of print by reference packet body that will follow. Exemplary

28   preferred OBEX header values for three different types of print by reference

29   operations are defined in Table 2:

Type Header Value	Description
text/x-ref-simple	Simple Reference
text/x-ref-xml	XML Reference
text/x-ref-list	Reference List

1

2   In FIG. 2a, for example, the OBEX packet header 20 indicates the body 22

3   contains a simple reference for printing by reference. With a reference list, a

4   single or multiple packets might include additional references to be processed,

5   each of which may be a simple reference but is preferably an XML reference as in

6   the example of FIG. 2b.

7   FIG. 3 shows a preferred environment and usage model in which the

8   protocol of the invention may be used. A print device 12 accesses a print service,

9   either via the Internet to a web site print service 24, or through another connection

10   to a local print service 26 that may comprise software in the print device 12 when

11   the print device 12 is carrying out a print-by-reference operation initiated by a

12   portable wireless device 10 that connects to the print device 12 via a wireless

13   protocol and the print by reference protocol of the invention. While the local print

14   service 26 is shown as an external device to the print device 12, it may also be

15   internal to the print device 12. For example, it may be native software or an add

16   on software. It might also be installed as a firmware card.

17   In a preferred use, the print device 12 accepts a print by reference

18   communication from the portable wireless device 10 and uses the print service 24

19   or 26 to resolve and access the content to be printed. The print service 24 or 26

20   executes a method that accepts, from a print client, a reference to print content

21   targeted for printing from a location indicated by the reference. The reference is

22   resolved to determine the location indicated by the reference. Print data is

23   obtained from that location and transcoded into a printer ready format. The print

1   client is allowed to access to print ready formatted data, which may be transferred

2   to the print client in response to a request from the print client.

3   A likely scenario involves the portable wireless device 10 accessing

4   a content provider 28, typically a web site over the Internet, via, for example via a

5   cellular wireless web protocol 29. The web site might include a link to print

6   content, such as a "print-this" link. If selected, the print by reference target is

7   transmitted to the portable wireless device 10 via web protocol 29, which then can

8   commence a print by reference operation with the print device 12. In the preferred

9   environment of FIG. 3, the portable wireless device 10 uses Bluetooth wireless 30

10   to communicate a print by reference target to the print device 12 by the protocol of

11   the invention.

12   After receiving a print by reference communication, the print device

13   12 then accesses the print service 24 via an Internet interface 30. However, the

14   protocol might also be used in communications between other devices. For

15   example, the portable wireless device 10 may use the protocol to initiate print by

16   reference directly with one of the print service 24 or 26.

17   A number of paths for passing a print reference by the protocol of

18   the invention are therefore possible. The protocol might also find use in other

19   environments to target content for printing. Underlying communication protocols,

20   e.g., Bluetooth, and wireless media may vary in applications of the invention.

21   Artisans will appreciate that the simple reference communications and meta tag

22   communication formats may be altered as necessary to suit a desired

23   communication protocol or wireless media.

24   Thus, while various embodiments of the present invention have been

25   shown and described, it should be understood that other modifications,

26   substitutions and alternatives are apparent to one of ordinary skill in the art. Such

27   modifications, substitutions and alternatives can be made without departing from

28   the spirit and scope of the invention, which should be determined from the

29   appended claims.

1   Various features of the invention are set forth in the appended

2   claims.